Advanced Holographic Phase Nulls Suitable for EUV Quality Optical Testing, Phase I

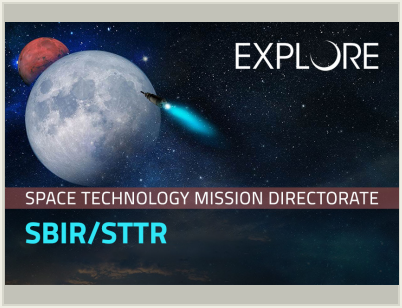
Completed Technology Project (2005 - 2005)

Project Introduction

A number of future space sciences missions require optical surfaces that are accurate to nanometer and sub-nanometer levels. These applications include large aperture systems such as the Terrestrial Planet Finder (TPF) chronograph, where mid-spatial frequency surface error content is restricted to 2 nm RMS, and EUV wavelength applications, like SHARPI, where full aperture surface errors need to be reduced to the single nanometer level. In most cases these optical systems require components which are generalized aspheres, with no simple point tests. Computer Generated Holographic (CGH) null optics are typically applied to test these optical surfaces. As the quality requirements placed upon these optics gets tighter, the precision associated with CGH manufacturing needs to improve as well. CGH's are produced using laser or e-beam based pattern generation tools which were originally developed for photomask generation in the lithography industry. Tinsley Laboratories proposes to develop CGH improvements in the area of substrate preparation and pattern placement errors. Tinsley, an industry leader in the application of CGH testing approaches, will work closely with Diffraction International, Inc. the industry leader in the area of CGH manufacturing. Tinsley's experience with the application of CGH tools, and our state-of-the-art Computer Controlled Optical Surfacing (CCOS) manufacturing processes, make us well suited to address issues related to implementation and substrate preparation. Diffraction International will provide support with regard to techniques which can provide improvements in the pattern placement area, and the evaluation of alternative manufacturing platforms that might be utilized to provide higher quality diffractive nulls. Our overall goal is to provide a 10x reduction in the residual error associated with current state-of-the-technology CGH null optics.

Anticipated Benefits

Commercial applications include projection and inspection optics for EUV lithography tools. EUV lithography tools are currently targeting moving from proof-of-principle into production, in the 2010 timeframe. At that point demand could be in the 100's instruments/year with multiple optics required for each instrument. The enhanced precision promised by the proposed process improvements has direct application to chronographic applications like the Terrestrial Planet Finder and future EUV missions such as SHARPI and SOLAR-B.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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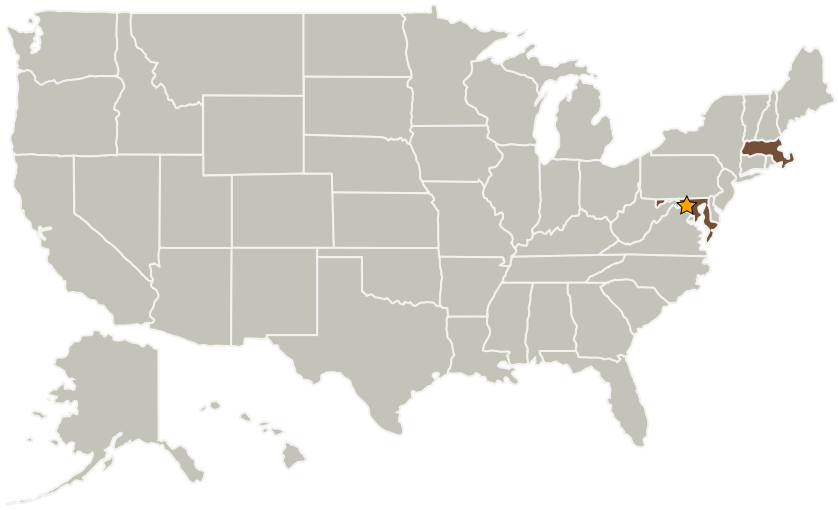
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
SSG Inc	Supporting Organization	Industry	Wilmington, Massachusetts

Primary U.S. Work Locations	
Maryland	Massachusetts

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Roger J Thomas

Principal Investigator:
Jay Daniel

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.3 Electronics and Optics Manufacturing Process